

DESCRIPTIONS OF THE LARVA AND PUPA OF
ANTHONOMUS HUNTERI AND COMPARISON WITH
ANTHONOMUS GRANDIS (COLEOPTERA: CURCULIONIDAE)¹

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Abstract.—The third-instar larva and the pupa of *Anthonomus hunteri* Burke and Cate are described and illustrated. Comparisons with the larval and pupal stages of *Anthonomus grandis* Boheman are made. The pupae of *A. hunteri* and *A. grandis* are easily separated on the difference in length of the rostrum, which is relatively shorter and stouter in *A. grandis* than in *A. hunteri*. Larvae of *A. hunteri* on the average are smaller than those of *A. grandis*, and head capsule widths may be used to separate most individuals, particularly of second and third instars.

Anthonomus hunteri was originally described from southern Mexico on the basis of adult specimens (Burke and Cate, 1979). More recently the immature stages of the species have been collected and associated with adults for positive identification. Since ecological and taxonomic studies are being conducted on *A. hunteri* and *Anthonomus grandis* Boheman in Mexico, it is necessary that the larvae and pupae of these species be sufficiently described and illustrated for identification and comparative purposes. The pupa of *A. grandis* was described by Anderson (1968) and Burke (1968) and the larva of this species by Ahmad and Burke (1972). Similar descriptions of the larval and pupal stages of *A. hunteri* will provide information for identification of these stages in ecological and parasite studies without the necessity of association with adults. Furthermore, this information will be useful in a phylogenetic study now being made on *Anthonomorphus* Dietz, the subgenus to which *A. hunteri* and *A. grandis* are presently assigned.

The terminology used in descriptions of the larva and pupa follows Anderson (1947) and Burke (1968), respectively.

DESCRIPTION OF THIRD-INSTAR LARVA

Figs. 1, 2, 3, 4

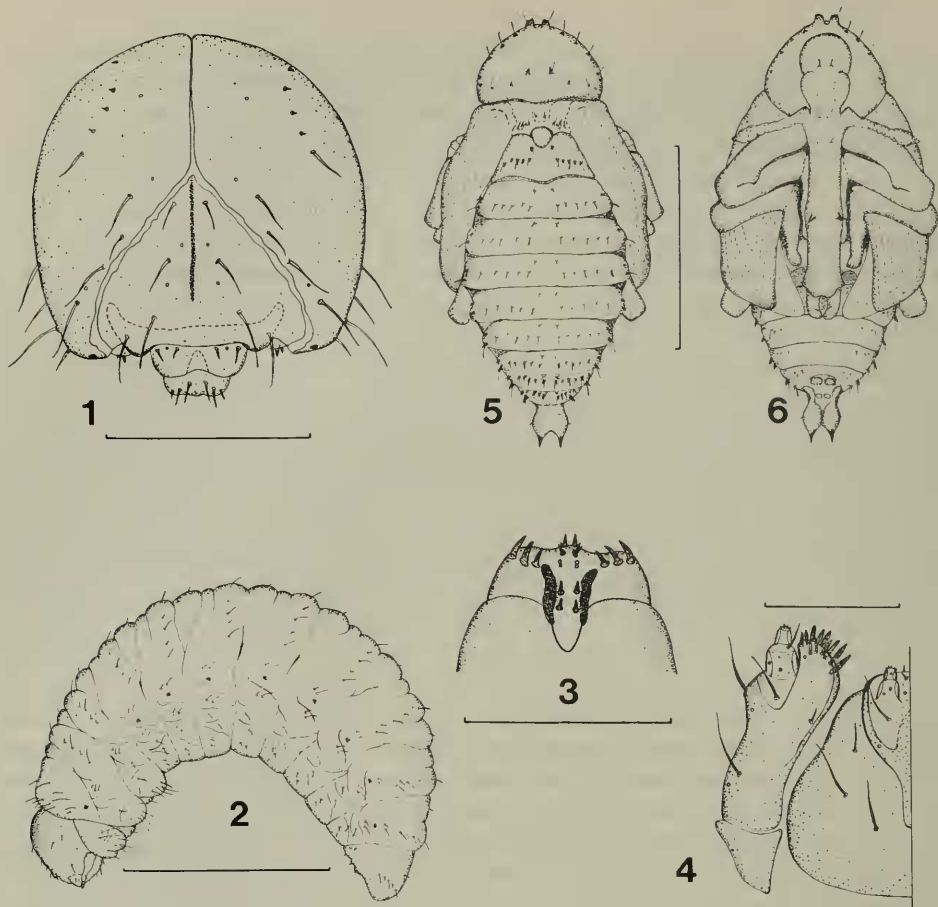
Body: Strongly curved (Fig. 2); length ca. 4 mm. Asperities tubercle-like, minute, inconspicuous; more extensively developed on thorax and dorsally on abdomen. Color white except for pronotum which is partially pale reddish brown.

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Head (Fig. 1): Yellowish to pale reddish; width 0.60–0.86 mm ($n = 72$). Basal article of antenna bearing conical accessory sensory appendage and 4 setae; one seta ca. $\frac{2}{3}$ length of conical appendage; other seta much shorter, not as stout. Endocarina distinct. Epicranial suture slightly less than $\frac{1}{2}$ length of head capsule. Four pairs of frontal setae present; seta 1 about $\frac{2}{3}$ to $\frac{3}{4}$ length of 3; frontal seta 3 distinctly longer than dorsal epicranial seta 3; frontals 4 and 5 about equal in length. Two pairs of frontal sensillae; one pair located near endocarina between frontal setae 1 and 3; one pair located between frontal setae 3 and 4, more or less in line with these setae. Five pairs of dorsal epicranial setae present; seta 1 longer than either 2 or 3, the latter 2 setae about equal in length; dorsal epicranial seta 3 located near frontal suture more or less in line with setae 1 and 4; setae 4 and 5 each longer than other setae. Four pairs of short, peglike postepicranial setae; arranged in an arc with anteriormost seta being located more or less directly above dorsal epicranial seta 2. Three pairs of epicranial sensillae; one pair located between postepicranial setae and epicranial suture; one pair borne dorsomedial of dorsal epicranial setae 1; one pair between dorsal epicranial setae 4 and 5 in line with these setae. Lateral epicranial seta 1 ca. $\frac{2}{3}$ length of 2. Ventral epicranial setae 1 and 2 nearly equal in length. Clypeal setae short, equal in length or one pair slightly longer than other; located close to anterior margin of frons. One pair of clypeal sensillae; member of pair on each side situated $\frac{1}{2}$ distance between clypeal setae 1 and 2. Three pairs of labral setae; setae 1 and 2 nearly equal in length; seta 3 much shorter. Epipharynx (Fig. 3) bearing 3 pairs of anteromedian setae; one pair much shorter than others. Three pairs of stout anterolateral setae present. Labral rods stout, converging slightly posteriorly. Four epipharyngeal sensory pores arranged with 2 pores lying adjacent to each other on each side of midline. Two pairs of stout epipharyngeal median spines present between labral rods. Mandibles each with 2 stout, rather bluntly pointed teeth; mandibular seta 1 distinctly longer than 2. Apical article of maxillary palp (Fig. 4) ca. $\frac{2}{3}$ length of basal article; basal article bearing one seta the length of which equals to about width of article. Stipital setae 1, 3, and 4 of equal length; seta 2 much shorter. Mala bearing 6 dorsal and 5 stout ventral setae. Labial palpus consists of 2 articles. Premental sclerite with a long posterior extension. Glossa with 4 short, stout setae. Postmental setae 1 and 2 each much longer than 3.

Thorax (Fig. 2): (Setae described on one side of body only.) Pronotum bearing 10 long setae and 1 or 2 short setae. Air tubes of thoracic spiracle each with 7–8 annuli. Prodorsal seta short. Five postdorsal setae present; setae 1, 3, and 5 distinctly longer than 2 and 4. Spiracular area bearing 3 setae, 2 of which are long and nearly equal in length, 3rd much shorter. Epipleural lobe with 1 moderately long seta. Two long pleural setae present on prothorax; 1 seta on each of meso- and metathorax. Pedal area bearing 4 long setae. Sternal seta much shorter than pedal seta.

Abdomen (Fig. 2): Each of first 7 abdominal segments bearing 3 distinct folds; segment VIII with only 2 well defined folds. Prodorsum of each segment with a short seta. Postdorsum bearing 5 pairs of setae; setae 1, 3, and 5 longer than 2 and 4. Two spiracular setae; seta 1 distinctly longer than 2. Pedal and eusternal setae short, inconspicuous. Anus subterminal, surrounded by 4 lobes. Segment IX subconical; apparently bearing same setae as on other abdominal segments but some are smaller; arrangement of setae also different than those on other segments.



Figs. 1-6. Larva and pupa of *Anthonomus hunteri*. 1, Frontal view of head capsule of larva. 2, Lateral view of third-instar larva. 3, Epipharynx of larva. 4, Ventral view of right maxilla and right half of labium of larva. 5, Dorsal view of pupa. 6, Ventral view of pupa. Line accompanying Fig. 1 = 0.5 mm; Figs. 2, 5, 6 = 2.0 mm; Figs. 3, 4 = 0.2 mm.

Material examined.—72 third-instar larvae from flower buds of *Hampea trilobata* Standley collected 20 mi. E. Celestún, Yucatán, Mexico, September 1981 by D. W. Williams. Determination made on basis of association with adults and by rearing. Other larvae representing first- and second-instars from the same host in the Celestún area were also examined.

DESCRIPTION OF PUPA

Figs. 5, 6

Body: Length 3.7–6.1 mm ($n = 22$).

Rostrum: Male rostrum extending slightly past apices of tarsi of mesothoracic legs, that of female extending nearly to apices of metathoracic tarsi. One pair of distirostral setae borne either apically or subapically on conical or cylindrical tubercles; setae fine, slightly longer than tubercles on which they are borne. Three

pairs of fine, short basirostral setae, arrangement of which is inconsistent, setae sometimes apparently unpaired.

Head: Supraorbital setae fine, straight; each about $\frac{1}{2}$ length of frontal seta; not borne on tubercles. Frontal setae stouter than supraorbitals, straight to slightly curved; each borne on summit of low tubercle; tubercles separated by distance equal to length of seta.

Prothorax: Prothoracic depressions absent. Pronotal setae straight to slightly curved; setae on anterior margin of pronotum longer and stouter than posterior setae. Anteromedian setae each borne on anterior face of large, bluntly pointed tubercle; length of each seta approximately equal to height of tubercle; a short, fine seta borne near inner anterior margin of tubercle. Anteromedian tubercles narrowly separated. Three pairs of anterolateral setae, each borne on the summit of low, flat-topped tubercle; tubercle 2 more or less spaced equally between 1 and 3; tubercles becoming progressively smaller laterally. Posteromedian setae each borne about $\frac{1}{2}$ distance between base and apex of sharply pointed, feebly curved tubercle; tubercles separated by distance equal to slightly less than length of seta. Four pairs of posterolateral setae usually present, sometimes only 3 pairs; all setae may be borne near bases of acutely pointed tubercles, or 2 outer setae may be located on summits of low tubercles. Posterolateral tubercle nearest midline largest of series; others decreasing in size laterally; tubercles not equidistant from each other as 2 outer ones are located closer together.

Mesonotum: Mesonotal setae usually consisting of 5 pairs of closely grouped slender, straight or curved setae each of which is borne near base of sharply pointed tubercle; occasionally only 3 or 4 pairs present. Mesonotal tubercles in each series usually differ considerably in size; tubercles 1, 3, and 5 often larger and bear longer setae than 2 and 4. One pair of minute anteronotal setae located ca. $\frac{1}{2}$ distance between mesonotal setae and anterior margin of mesonotum; each borne at base of sharply pointed tubercle.

Metanotum: Five pairs of metanotal setae similar to mesonotals except for being more widely separated; setae 2 and 4 much shorter than 1, 3, and 5; each borne at base or near middle of sharply pointed tubercle. One pair of minute anteronotal setae each of which is borne near base of relatively large, sharply pointed tubercle.

Abdomen: Five pairs of discotergal setae present on segments I–VII; segment VIII may bear 3, 4, or 5 pairs, setae 2 and 4 of which are shorter than 1, 3, and 5; discotergal setae on segments VI, VII, and VIII borne at bases of sharply pointed tubercles; on other abdominal segments a seta may occasionally be associated with a minute, sharply pointed tubercle; usually setae not associated with tubercles or borne on summits of low tubercles. One pair of minute anterotergal setae borne on low, rounded tubercles on each of first 8 abdominal segments. Laterotergal setae 1 and 2 borne on each of first 8 terga; seta 1 minute, borne at base of small, sharply pointed tubercle; seta 2 prominent, borne at base of sharply pointed tubercle, the latter becoming progressively larger posteriorly. Spiracles well developed on first 5 abdominal segments; poorly developed on 6th segment. Two pairs of laterosternal setae present on each segment, located directly ventrad of laterotergal seta 2; ventralmost seta ca. $2\times$ longer than other member of pair; both pale and inconspicuous. One pale, sub-laterosternal seta borne on each segment. Segment IX bearing a pair of sharply pointed, widely separated posterior

processes; setae on segment minute, including 1 pair dorsally at bases of processes and an oblique line of 3 setae laterally on each side of segment near base.

Material examined.—22 pupae taken from buds of *Hampea trilobata* 20 mi. E. Celestún, Yucatán, Mexico, September 1981 by D. W. Williams.

DISCUSSION

On the basis of adult characters (Burke and Cate, 1979), *A. hunteri* and *A. grandis* appear to be closely related species. They are presently assigned to the subgenus *Anthonomorphus* Dietz, along with *Anthonomus fulvus* LeConte, *Anthonomus peninsularis* Dietz, *Anthonomus texanus* Dietz, and *Anthonomus cognatus* Burke. In addition to those of *A. hunteri* and *A. grandis*, the larvae and pupae of *A. fulvus* and *A. texanus* are known, thus allowing comparison of these stages for the four species.

Larva.—Distinguishing the pupa of *A. hunteri* from that of *A. grandis* may be accomplished easily by comparing the rostrum lengths, but differentiation of larvae of the two species is a more difficult task. The third-instar larva of *A. hunteri* traces to *A. grandis* in a key to anthonomine larvae by Ahmad and Burke (1972), supporting the close similarity of the two as also evidenced by comparison of their pupal and adult stages. One of the problems in distinguishing larvae of closely related weevil species is the lack of information about normal variation in the number, size, and arrangement of setae. Most curculionid larvae have been described on the basis of small series of specimens; however, this meager evidence indicates that there is sometimes considerable intraspecific variation in chaetotaxy, thus greatly reducing the value of setal characters for taxonomic purposes. The larvae of *A. hunteri* and *A. grandis* are so closely similar that the few slight differences noted in locations and relative lengths of setae are likely to be due to individual variation rather than to species differences.

The only consistent differences between the larvae of the two species appear to be in head capsule widths, reflecting the generally smaller size of *A. hunteri*. The measurements of *A. hunteri* reported here were obtained from 96 field-reared larvae. These specimens were reared to establish the number and duration of the various instars. Specimens representing each of the three instars were preserved for the present study. Measurements obtained from these specimens are compared with those reported in the literature on *A. grandis* by Ahmad and Burke (1972) and Parrott et al. (1970). The measurements reported by Ahmad and Burke for third-instar larvae were made on specimens from several host plant species and from different localities. The measurements reported by Parrott et al. were obtained from individuals reared on an artificial diet. In the following comparisons the ranges of widths and number of specimens measured (when known) are included in parentheses following the means.

The mean head width of first-instar larvae of *A. hunteri* is 0.37 mm (0.35–0.40; $n = 8$) as compared to 0.41 mm (0.37–0.42) for *A. grandis* reared on artificial diet. Second-instar larvae of *A. hunteri* average 0.52 mm (0.44–0.57; $n = 9$) in head width in comparison to 0.62 mm (0.55–0.65) for *A. grandis*. Third-instar larvae of *A. hunteri* measured have a mean width of 0.75 mm (0.60–0.86; $n = 72$), while Parrott et al. reported a mean of 0.99 mm for *A. grandis* reared on artificial media. Ahmad and Burke (1972) reported a mean of 1.1 mm (0.96–1.2; $n = 34$) for *A. grandis* larvae from different host species and localities. These data

indicate that head capsule width measurements not only will distinguish the three instars of each species but also will serve to separate at least the second- and third-instar larvae of *A. hunteri* from those of *A. grandis*. This character should be especially useful for identification if a series of specimens is available.

Pupa.—The pupa of *A. hunteri* traces to *A. grandis* in the key provided by Burke (1968) for identification of pupae of the anthonomine weevils.

The pupae of *A. hunteri*, *A. grandis*, *A. fulvus*, and *A. texanus* collectively are distinguished from almost all other anthonomine pupae known (approximately 55 species) by having five pairs of discotergal setae and a pair of laterosternal setae. Three species (*A. hunteri*, *A. grandis*, and *A. fulvus*) have anterotergal setae, a pair of minute setae present near the anterior margin of each of the first eight abdominal terga; these setae are not known to occur in any other species of the subfamily. The pupae of *A. hunteri* and *A. grandis* may be separated from those of *A. fulvus* and all other known anthonomine pupae by possessing a pair of median setae (anteronotal setae) on both the mesonotum and the metanotum. In addition to sharing this character, *A. hunteri* and *A. grandis* are the only species of anthonomines known to develop in buds of *Hampea* (Malvaceae).

Since these two species of weevils are quite similar, are sympatric in southern Mexico, and both develop in *Hampea* buds (although apparently not on the same species), it is important to be able to distinguish them in all developmental stages. This can be done with the pupae of the two species with relative ease. Both sexes of pupae of *A. hunteri* have the rostrum extending well past the apices of the tarsi (Fig. 6) of the mesothoracic legs. The pupal rostrum of *A. grandis* is relatively stouter and shorter and does not extend past the apices of these tarsi. This difference should serve to separate pupae of the two species without reference to other characters. However, in case there is some doubt on this point, we also noticed that *A. hunteri* pupae have only one pair of distirostral setae while *A. grandis* pupae often have two pairs. In addition to the above-mentioned differences, pupae of *A. hunteri* usually are smaller than those of *A. grandis*; 22 specimens of *A. hunteri* taken from buds of *Hampea trilobata* in the State of Yucatán, Mexico, ranged in length from 3.7–6.1 mm, with a mean of 4.7 mm. In comparison, 21 pupae of *A. grandis* from buds of *Hampea nutricia* Fryxell collected at Cardenas, Tabasco, Mexico, measured 5.4–6.6 mm, with a mean length of 6.0 mm; eight pupae from *Gossypium barbadense* L. in Yucatán ranged from 5.5–6.8 mm in length, mean 6.4 mm; and 20 from cultivated *Gossypium hirsutum* L. in Briscoe Co., Texas, varied from 5.7 to 8.2 mm, mean 6.9 mm. Although the size of pupae of *A. grandis* is quite variable, depending upon condition of host plants and developmental sites (buds vs. fruits), the measurements presented here indicate a relatively larger size for this species.

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